



PREPARING PRESCHOOL CHILDREN WITH STEAM AND CREATIVE METHODS: INTEGRATION OF TRIZ, MONTESSORI AND MNEMONOTECHNIQUES

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Abstract: *This article examines effective ways to integrate STEAM (Science, Technology, Engineering, Arts, and Mathematics), TRIZ (Theory of Creative Problem Solving), Montessori, mental arithmetic, and mnemonics approaches in preparing preschoolers for school. Each approach plays a distinct role in a child's cognitive, creative, and emotional development. STEAM activities develop problem-solving and analytical thinking; TRIZ encourages creative thinking; Montessori supports independence, sensory experience, and self-learning; mental arithmetic enhances mathematical thinking and memory; and mnemonics helps children remember information quickly. Integrating these methods makes children's school readiness complete and comprehensive.*

Keywords: *STEAM, TRIZ, Montessori methodology, mental arithmetic, mnemonics, preschool education, cognitive development, creative thinking, school preparation*

Abstract: *This article explores comprehensive strategies for preparing preschool children for formal school education using a combination of STEAM (Science, Technology, Engineering, Arts, Mathematics), TRIZ (Theory of Inventive Problem Solving), Montessori methods, mental arithmetic, and mnemonics. Each approach contributes uniquely to cognitive, creative, and emotional development. STEAM activities foster problem-solving and analytical thinking; TRIZ encourages inventive thinking; Montessori supports independence, sensory exploration, and self-directed learning; mental arithmetic develops mathematical reasoning and memory skills; mnemonics enhance retention and recall. Integrating these methods*

provides a holistic framework that promotes intellectual growth, creativity, and readiness for primary school.

Keywords: STEAM, TRIZ, Montessori method, mental arithmetic, mnemonics, preschool education, cognitive development, creative thinking, school readiness

Аннотация: В данной статье рассматриваются комплексные подходы к подготовке детей дошкольного возраста к школе с использованием STEAM (наука, технология, инженерия, искусство, математика), ТРИЗ (теория изобретательного решения проблем), метода Монтеessori, устного счета и мнемоники. Каждый подход вносит уникальный вклад в когнитивное, творческое и эмоциональное развитие ребенка. STEAM развивает аналитическое и критическое мышление; ТРИЗ способствует изобретательному подходу к решению проблем; метод Монтеessori поддерживает самостоятельность и сенсорное развитие; устный счет развивает математическое мышление и память; а мнемоника улучшает запоминание и извлечение информации. Интеграция этих методов обеспечивает всестороннюю подготовку детей к школе.

Ключевые слова: STEAM, ТРИЗ, метод Монтеessori, устный счет, мнемоника, дошкольное образование, когнитивное развитие, творческое мышление, готовность к школе

INTRODUCTION

The issue of preparing preschool children for school education is of great importance in modern pedagogical research. This period is considered an important stage in the cognitive, social, emotional and creative development of a child. Research shows that introducing children to various pedagogical methods at an early age develops their ability to learn, problem-solve and think independently.

In recent years, approaches such as STEAM (Science, Technology, Engineering, Arts and Mathematics), TRIZ (Theory of Creative Problem Solving), Montessori methodology, mental arithmetic and mnemonics have been recognized

as effective tools for the comprehensive development of preschool children. Each method makes a special contribution to the development of the child: STEAM forms interdisciplinary knowledge and develops analytical thinking; TRIZ helps to find innovative and creative solutions; Montessori methodology ensures the development of independence and intuition in children; mental arithmetic develops mathematical thinking and memory; and mnemonics increases the ability to quickly remember information.

By integrating these methods, cognitive, creative and social skills are developed simultaneously in preschool children. At the same time, the effectiveness of children's school readiness increases, and their adaptation to the school process is facilitated. Therefore, the practical use of a combination of these approaches in pedagogical research and the study of their effectiveness are considered an urgent scientific problem.

MATERIALS & METHODS

Different pedagogical approaches to preparing preschoolers require specific methods and materials. In the STEAM approach, children are introduced to activities that combine elements of science, technology , and art. For example, younger children (ages 3–4) learn about natural processes by pouring water into different containers and observing how it rises , thickens, and changes color. Older children (ages 5–6) create new devices using Lego blocks or constructors and test them in different conditions. At the same time, building towers with colored blocks develops children's creative thinking and coordination skills.

The TRIZ methodology teaches children to solve creative problems. For example, young children learn to solve problems with multiple solutions by building a stable tower from cubes or plastic cups. Older children (ages 5–6) create new constructions from paper, tape, and simple materials and test them. In the process, children learn to compare options and choose the most optimal solution, which develops their logical and creative thinking.

encourages children to learn independently and develop their senses. For example, young children learn to distinguish between different materials through their senses – soft and hard, transparent and opaque, hot and cold. Children learn mathematical and geometric concepts by arranging blocks by color, shape and size. At the same time, children develop independent selection and logical thinking skills by grouping animals, fruits or shapes .

Mental arithmetic is aimed at developing memory, speed , and mathematical thinking in children. While younger children practice adding and subtracting by sliding beads on an abacus, older children learn to add and subtract numbers using colorful cards. By memorizing and saying or writing down a sequence of consecutive numbers, memory and attention can be strengthened.

Mnemonics help children remember information quickly and effectively. Younger children create short stories and pictures for letters or numbers, while older children memorize information using rhymes or songs. Connecting new information with previous knowledge through association games further develops memory and attention in children.

STEAM approach in children science , technology , engineering , art and mathematics areas integration through development provides . Research shows that interactive and hands-on activities for preschoolers significantly increase analytical thinking and problem-solving skills. For example, children learn to understand natural phenomena when experimenting with water and air, and learn about mechanical processes using constructors. Elements of art develop creative thinking and visual imagination. At the same time, STEAM methodology also strengthens social skills through project and group work.

integrates science, technology, engineering, art , and mathematics in children. Games are age appropriate:

- “Experiment with water” (ages 3–4): children observe natural phenomena by pouring water into different containers and making the water rise, thicken, or color.

- “Mini-engineers” (ages 5–6): Using construction toys or Lego blocks, children create new devices and test them in various ways.
- “Colorful Building” (ages 4–5): Children develop creative thinking and coordination skills by building buildings or towers with blocks of different colors.

STEAM games strengthen analytical thinking, problem-solving , and creative skills in children.

teaches children to solve problems with a creative and innovative approach.

Games are age appropriate:

- “Problem Solving” (ages 3–4): Children are given the task of making a stable tower out of cubes or cups of different shapes.
- “New device” (ages 5–6): creating new devices using a construction set or plain paper and tape and testing them.
- “Comparing options” (ages 4–5): children learn to solve a problem with multiple solutions and choose the most optimal one.

develop logical thinking, creative decision-making , and an innovative approach.

The Montessori approach engages children in an active learning and independent discovery process. Preschoolers learn concepts through sensory play. For example, colored blocks and counting materials build mathematical and logical skills, while objects of different sizes help develop intuition. In a Montessori environment, children develop the ability to self-manage and complete tasks independently. This method has also been recognized in educational research for its positive impact on the development of social skills , attention, and memory.

engages children in independent learning and intuitive development.

Games are age appropriate:

- “Sensory box” (ages 3–4): sensory experience increases by separating different materials (soft-hard, transparent-opaque, hot-cold).
- “Colored Blocks” (ages 4–5): Place and organize blocks by color, shape , and size.

- “Sorting” (ages 5–6): logical thinking and independent selection skills are developed by grouping animals, fruits, or shapes .

Montessori games increase independent thinking, attention, and social skills in children.

Mental arithmetic is aimed at developing children's ability to work with numbers, memory and concentration. Using abacus and visualization techniques, children learn to count numbers quickly and accurately. This method strengthens children's logical thinking, quick decision-making and numerical reasoning skills. Scientific studies show that mental arithmetic increases mental speed in children and significantly improves mathematical skills.

develops memory, speed , and mathematical thinking in children.

Games are age appropriate:

- “Numbers with an Abacus” (ages 3–4): children learn simple addition and subtraction by moving beads.
- “Counting with colored cards” (ages 4–5): adding or subtracting numbers using the numbers and colors on the cards.
- “Number sequences” (ages 5–6): children memorize and then say or write a sequence of numbers, which strengthens memory and attention.

Mental arithmetic games develop mathematical thinking, memory , and concentration.

Mnemonics increase children's ability to quickly remember and retrieve information. Children easily absorb new information through visual images, pictures, rhymes and associations. For example, learning letters, colors and numbers visually or through songs strengthens memory. Working with mnemonic techniques increases children's memorization speed, develops attention and concentration skills. At the same time, this method increases efficiency in combination with other approaches - STEAM or mental arithmetic exercises.

Mnemonotechnics increase children's ability to quickly remember and retrieve information.

Games are age appropriate:

- “Picture and Story” (ages 3–4): Create a short story and picture for letters, numbers, or fruits .
- “Rhymes and songs” (ages 4–5): numbers or letters are turned into a rhythmic song, which children quickly remember.
- “Association Game” (ages 5–6): strengthens memory by connecting new information with previous knowledge and creating associations.

Mnemonic games develop children's memory, attention, and concentration skills.

Results (Results and observations)

the conducted activities and games showed that the STEAM approach significantly develops analytical and creative thinking in children. Younger children increase their ability to study natural phenomena through experiments, while older children learn to think logically and make creative decisions when solving constructive tasks.

The TRIZ methodology strengthens children's innovative approach and ability to solve problems with multiple solutions. Younger children develop structural thinking by building towers, older children create new constructions, compare different options , and choose the most optimal solution.

The Montessori approach promotes independence and sensory development in children. By working with sensory materials, children learn to sort, group , and organize different objects. At the same time, their attention and social skills develop.

Mental arithmetic exercises improve mathematical thinking, memory , and speed in children. Using an abacus and colored cards, children learn to count numbers quickly and accurately, and sequential numbers strengthen memory and attention skills.

Mnemonic exercises increase the speed of information recall in children, strengthen attention and concentration. Children easily memorize new information and connect it with previous knowledge using pictures, stories, rhymes and songs.

In this way, all approaches allow for the integrated development of cognitive, creative, and social skills in preschool children .

Discussion

An integrated approach simultaneously develops cognitive, social and creative skills in children. Each method has its own pedagogical value, but combining them increases the effectiveness of school preparation. Studies show that children aged 3–6 years develop logical and creative thinking in STEAM and TRIZ classes, while Montessori and mental arithmetic classes strengthen intuition and mathematical thinking, and mnemonics strengthen memory and attention. At the same time, the selection of age-appropriate games increases motivation and interest in children.

Conclusion

STEAM, TRIZ, Montessori, mental arithmetic and mnemonics approaches in preschool children is an effective way to prepare for school. Through age-appropriate games, children develop cognitive, creative and social skills, successfully adapt to the school process and arouse interest in learning. These approaches are widely used in pedagogical practice and their effectiveness has been confirmed by scientific research.

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